IN REPLY
REFER TO: Joint Interoperability Test Command (JTD)   **2 Feb 15**

MEMORANDUM FOR DISTRIBUTION   Revision 1

SUBJECT: Joint Interoperability Certification of the Thinklogical, Velocity Closed Video
Matrix Switching Solution, Software Revision 4

References: (a) Department of Defense Instruction 8100.04, "DoD Unified Capabilities (UC),"
9 December 2010
(b) DoD CIO, Memorandum, "Interim Guidance for Interoperability of Information
Technology (IT) and National Security Systems (NSS)," 27 March 2012
(c) through (e), see Enclosure 1

1. **Certification Authority.** References (a) and (b) establish the Joint Interoperability Test
Command (JITC) as the Joint Interoperability Certification Authority for the Unified Capabilities
(UC) products.

2. **Conditions of Certification.** Thinklogical, Velocity Closed Video Matrix Switching
Solution, Software Revision 4; hereinafter referred to as the System Under Test (SUT), meets the
critical requirements of the Unified Capabilities Requirements (UCR) 2013, Reference (c), and is
certified for joint use as a closed Video Distribution System (VDS) with the conditions described
in Table 1. This certification expires upon changes that affect interoperability, but no later than
three years from the date of the Unified Capabilities (UC) Approved Products List (APL)
memorandum.

Table 1. Conditions

Condition	Operational Impact	Remarks
UCR Waivers		
None.		
Conditions of Fielding		
None.		
Open Test Discrepancies		
The VDS Matrix Switch (MX-48 Router) was unable to identify input and original signal resolution.	Minor	See note 1.
The SUT does not have a device or method present to support remote control diagnostics or operation of VPCCs and Signal Extenders	Minor	See note 2.

Table 1. Conditions (continued)

NOTES: 1. DISA has adjudicated this discrepancy as minor and stated the intent to change this requirement in the next version of the UCR to optional or conditional. 2. DISA has adjudicated this discrepancy as minor and stated the intent to change this requirement in the next version of the UCR to conditional.

LEGEND:			
DISA	Defense Information Systems Agency	VDS	Video Distribution System
SUT	System Under Test	VPCC	VDS Peripheral Connector Conversion
UCR	Unified Capabilities Requirements		

3. **Interoperability Status.** Table 2 provides the SUT interface interoperability status and Table 3 provides the Capability Requirements (CR) and Functional Requirements (FR) status. Table 4 provides a UC APL product summary.

Table 2. Interface Status

Interface	Threshold CR/FR Requirements (See note 1.)	Status	Remarks
Closed VDS Interfaces			
Serial (TIA-232) (C)	1, 2, 4	Not Tested	See note 2.
Serial (TIA/EIA-422) (C)	1, 2, 4	Not Tested	See note 2.
Serial (EIA-485) (C)	1, 2, 4	Not Tested	The SUT does not support this conditional interface.
HDMI (C)	1, 2, 4	Met	
VGA (C)	1, 2, 4	Met	
DVI (C)	1, 2, 4	Met	
Multi-rate SDI (C)	1, 2, 4	Met	
HD-SDI	1, 2, 4	Met	
USB HID	1, 2, 4	Met	See note 3.
VDS-IP Interfaces			
Serial (TIA-232) (C)	1, 3, 4, 5	Not Tested	The SUT is a closed VDS; therefore, this does not apply.
10Base-X (C)	1, 3, 4, 5	Not Tested	The SUT is a closed VDS; therefore, this does not apply.
100Base-X (C)	1, 3, 4, 5	Not Tested	The SUT is a closed VDS; therefore, this does not apply.
1000Base-X (C)	1, 3, 4, 5	Not Tested	The SUT is a closed VDS; therefore, this does not apply.
Management Interfaces			
Serial (TIA-232) (C)	1, 5	Met	See note 2.
10/100/1000BaseT (C)	1, 5	Met	See note 4.

NOTES:
1. The SUT high-level CR and FR ID numbers depicted in the Threshold CRs/FRs column can be cross-referenced in Table 3. These high-level CR/FR requirements refer to a detailed list of requirements provided in Enclosure 3.
2. Closed VDS Systems shall support serial RS-232, RS-422, or RS-485 interfaces as required by the system. Although the vendor's LoC states compliance to these serial interfaces, only the RS-232 was tested and certified for use to manage the system.
3. The USB HID interface is an interface that supports High Definition video and audio. This is not a required interface. This interface was tested and is certified in a point-to-point configuration. This interface was not tested and is not certified over a local area network.
4. The 10BaseT interface is used by a workstation located in a logically and physically separated VDS System. SPAWAR analysis determined that the 10BaseT interface is a low risk for certification based on testing and complies with the IEEE 802.3i standard and the testing data collected at all other data rates.

LEGEND:			
Base-T	Ethernet generic designation (Baseband)	LoC	Letter of Compliance
C	Conditional	RS	Recommended Standard
CR	Capability Requirements	SDI	Serial Digital Interface
DVI	Digital Visual Interface	SPAWAR	Space and Naval Warfare Center
EIA	Electronic Industries Alliance	SUT	System Under Test
FR	Functional Requirements	TIA	Telecommunications Industry Association
HD	High Definition	UCR	Unified Capabilities Requirements
HDMI	High Definition Multimedia Interface	USB	Universal Serial Bus
HID	Human Interface Device	VDS	Video Distribution System
IEEE	Institute of Electrical and Electronics Engineers	VGA	Video Graphics Array

Table 3. SUT Capability Requirements and Functional Requirements Status

CR/FR ID	UCR Requirement (High-Level) (See note 1.)	UCR 2013 Reference	Status
1	General VDS System	9.1	Met
2	Closed VDS System	9.2	Met
3	VDS over IP (VDS-IP)	9.3	Not Tested (See note 2.)
4	VDS Recording	9.4	Not Tested (See note 2.)
5	Quality of Service Features for IP Interfaces	7.2.1.6	Not Tested (See note 2.)

NOTES:
1. The annotation of "required" refers to a high-level requirement category. The applicability of each sub-requirement is provided in Enclosure 3.
2. The SUT does not support this requirement and it is not required for a closed VDS system.

LEGEND:
CR	Capability Requirement	SUT	System Under Test
FR	Functional Requirement	UCR	Unified Capabilities Requirements
ID	Identification	VDS	Video Distribution System
IP	Internet Protocol		

Table 4. UC APL Product Summary

Product Identification			
Product Name	Thinklogical Velocity Closed Video Switching Matrix Solution		
Software Release	4.0		
UC Product Type(s)	Video Distribution System (VDS)		
Product Description	The SUT provides video transmission capability utilizing different motion picture format over a closed network.		
Product Components	Component Name (See note 2.)	Versions	Remarks
VDS Matrix Switch	**MXR-00048-FM,** MXR-000048-FM REV B, MXR-000048-RM, MXR-000048-RM REV B, MXR-000048-SA, MXR-000048-SA REV B, MXR-000E48, MXR-000E48-FM, MXR-000E48-RM, MXR-000E48-SA, MXR-000S48, MXR-000S48-FM, MXR-000S48-RM, MXR-000S48-SA, MXR-A00048-SA	Linux 2.6.25.10.atmel.2 BusyBox v1.12.1	
VDS Signal Extenders	**VEL-W00M08-LCTX, VEL-W00M08-LCRX, VEL-AV0M12-LCTX, VEL-0H00003-LCRX, VTS-004200, VTM-U00004-LCTX, VTM-U00004-LCRX, VQS-004300, VQM-0H0003-LCTX, VQM-HA0006-LCRX, VQM-UAP001-LCTX, VQM-UAP001-LCRX, SDC-000001-LC, HDC-000001-LC, SDI-C100X1-LCRX**	Firmware Version v1.01 Firmware Version v2.0 Firmware Version v20.04 Firmware Version v21.12 Firmware Version v22.12 Firmware Version v22.13 Firmware Version v51.20 Firmware Version v52.11	See note 3.
VDS Master Control Switch	**MXM-000004**	Firmware v1.01	
Management Workstation	Site-Provided, STIG-compliant Computer	Microsoft Windows 7 X4 Configurator X44.02.41	

NOTES:
1. The detailed component and subcomponent list is provided in Enclosure 3.
2. Components bolded and underlined were tested by SPAWAR. The other components in the family series were not tested but are also certified for joint use by similarity. SPAWAR certifies those additional components because they utilize the same software/ firmware and similar hardware. SPAWAR analysis determined them to be functionally identical for interoperability certification purposes.
3. A complete listing of all devices certified by similarity can be found in Enclosure 3.

Table 4. UC APL Product Summary (continued)

LEGEND:			
APL	Approved Products List	SPAWAR	Space and Naval Warfare Center
DoD	Department of Defense	SUT	System Under Test
JITC	Joint Interoperability Test Command	STIG	Security Technical Implementation Guides
MXR	Matrix Router	TX	Transmit
OS	Operating System	UC	Unified Capabilities
RX	Receive	VDS	Video Distribution System

4. **Test Details.** This certification is based on interoperability testing, review of the vendor's Letters of Compliance (LoC), Defense Information Systems Agency (DISA) adjudication of open test discrepancy reports (TDRs), and DISA Certifying Authority (CA) Recommendation for inclusion on the UC Approved Products List (APL). Testing was conducted at the SPAWAR UC APL Test Laboratory at St Juliens Creek, Portsmouth, Virginia, from 07 April 2014 through 09 April 2014, using test procedures derived from Reference (d). Review of the vendor's LoC completed on 25 August 2014. DISA adjudication of outstanding TDRs was completed on 23 September 2014.   The DISA CA provided a positive Recommendation based on the security testing completed by SPAWAR UC APL Test Laboratory-led Information Assurance (IA) test teams and the results published in a separate report, Reference (e). Enclosure 2 documents the test results and describes the tested network and system configurations. Enclosure 3 provides a detailed list of the interface, capability, and functional requirements. Enclosure 4 provides a list of errata changes to this certification since the original signature date.

5. **Additional Information.** JITC distributes interoperability information via the JITC Electronic Report Distribution (ERD) system, which uses Sensitive but Unclassified IP Data (formerly known as NIPRNet) e-mail. Interoperability status information is available via the JITC System Tracking Program (STP). STP is accessible by .mil/.gov users at https://stp.fhu.disa.mil/. Test reports, lessons learned, and related testing documents and references are on the JITC Joint Interoperability Tool (JIT) at https://jit.fhu.disa.mil/. Due to the sensitivity of the information, the Information Assurance Accreditation Package (IAAP) that contains the approved configuration and deployment guide must be requested directly from the Unified Capabilities Certification Office (UCCO) (by government civilian or uniformed military personnel), e-mail: disa.meade.ns.list.unified-capabilities-certification-office@mail.mil. All associated information is available on the DISA UCCO website located at http://www.disa.mil/Services/Network-Services/UCCO.

JITC Memo, JTE, Joint Interoperability Certification of the Thinklogical, Velocity Closed Video Matrix Switching Solution, Software Revision 4

6. **Point of Contact (POC).** The SPAWAR UC APL Test Laboratory testing point of contact is Mr. Leroy Fung, commercial (757) 541-6794 or DSN (312) 578-6794; e-mail address leroy.a.fung@navy.mil. The JITC certification point of contact is Capt. Soamva Duong, commercial telephone (520) 538-5269; e-mail address soamva.duong.fm@mail.mil; mailing address Joint Interoperability Test Command, ATTN: JTE (Capt. Soamva Duong) P.O. Box 12798, Fort Huachuca, AZ 85670-2798. The UCCO tracking number for the SUT is 1324203.

FOR THE COMMANDER:

4 Enclosures a/s

for RIC J. HARRISON
   Chief
   Networks/Communications and UC Portfolio

Distribution (electronic mail):
DoD CIO
Joint Staff J-6, JCS
USD(AT&L)
ISG Secretariat, DISA, JTA
US Strategic Command, J665
US Navy, OPNAV N2/N6FP12
US Army, DA-OSA, CIO/G-6 ASA(ALT), SAIS-IOQ
US Air Force, A3CNN/A6CNN
US Marine Corps, MARCORSYSCOM, SIAT, A&CE Division
US Coast Guard, CG-64
DISA/TEMC
DIA, Office of the Acquisition Executive
NSG Interoperability Assessment Team
DOT&E, Netcentric Systems and Naval Warfare
Medical Health Systems, JMIS IV&V
HQUSAISEC, AMSEL-IE-IS
UCCO

ADDITIONAL REFERENCES

(c) Office of the Department of Defense Chief Information Officer, "Department of Defense Unified Capabilities Requirements 2013, Errata 1," 1 July 2013
(d) Joint Interoperability Test Command, "Video Distribution System (VDS) Test Procedures for Unified Capabilities Requirements (UCR) 2013," Draft
(e) Space and Naval Warfare Center (SPAWAR) Atlantic, "Information Assurance Assessment Report for Thinklogical, Velocity Closed Video Switching Matrix Solution, Revision 4 (Tracking Number: 1324203)," Draft

CERTIFICATION SUMMARY

1. SYSTEM AND REQUIREMENTS IDENTIFICATION.

The Thinklogical, Velocity Closed Video Matrix Switching Solution, Software Revision 4 is hereinafter referred to as the System Under Test (SUT). Table 2-1 depicts the SUT identifying information and requirements source.

Table 2-1. System and Requirements Identification

System Identification	
Sponsor	United States Navy
Sponsor Point of Contact	Lee Boaman, SPAWARSYSCEN Atlantic, e-mail: lee.boaman@navy.mil Scott Houghton, SPAWARSYSCEN Atlantic, email: scott.houghton@navy.mil
Vendor Point of Contact	Molly Volenec, e-mail: mollyv@thinklogical.com
System Name(s)	Thinklogical Velocity Closed Video Matrix Switching Solution
Increment and/or Version	Revision 4
Product Category	Video Distribution System
System Background	
Previous certifications	None
Tracking	
UCCO ID	1324203
System Tracking Program ID	4759
Requirements Source	
Unified Capabilities Requirements	Unified Capabilities Requirements 2013, Errata 1
Remarks	
Test Organization(s)	Space and Naval Warfare Center (SPAWAR)
LEGEND: E-mail Electronic Mail UCCO Unified Capabilities Certification Office ID Identification	

2. SYSTEM DESCRIPTION.

A Video Distribution System (VDS) is a complement of audio and video equipment designed for interfacing, switching/bridging, and distributing digital and/or analog audio and video signals sourced from multiple devices and destined to multiple devices. Unlike a Video Teleconferencing (VTC) Multipoint Conferencing Unit (MCU), which performs solely many-to-one audio and video signal bridging, the VDS can perform many-to-one, one-to-many, and many-to-many bridging. The VDS can distribute signal feeds to geographically dispersed locations and may include types of "METADATA" that might include intelligence about the feed (e.g., signal feed coordinates, Predator target) or industry standard information such as Extended Display Identification Data (EDID), which is a data structure that provides additional information about the intended display devices.

Closed VDS System: Closed VDS systems do not interface with the Defense Information Systems Network (DISN) core. A Closed VDS System is a traditional VDS that enables video distribution over a Time Division Multiplexing (TDM)-based network that can occasionally support IP capabilities in a closed environment, and is capable of enabling Society of Motion Picture and TV Engineers (SMPTE) signals to be transmitted over a digital infrastructure. Closed VDS systems can leverage legacy standards and traditional TDM VDS, and are inaccessible from DoD IP-routed networks. However, a Closed VDS system may use a

peripheral device to extract video from an IP transport and convert it to an SMTP digital data stream, and pass it through the VDS.

The System Under Test (SUT) is a closed video matrix extension and distribution system. This is a physically and logically separated, isolated network. The SUT includes video distribution as well as other computer interfaces such as keyboard and mouse. The certified interfaces are all internal to the system and the SUT will not connect to the Defense Information Systems Network (DISN). Management and initial setup of the system is accomplished by a windows 7 workstation running a web-based application named X4 Configurator. A touch screen panel is also used for the day-to-day operation of the system.

MXR-000048-FM: Thinklogical MX routers are true non-blocking matrix switches and leverage bi-directional signal capability. The MX48 are part of the VX Router family, which ranges in size from 48 x 48 up to 640 x 640. Our non-blocking routers allow multiple input signals to be available at one output. A bandwidth of 6.25 Gbps allows for uncompressed video, with no frame dropping. It supports both multi-mode and single-mode fiber connections using industry standard SFP+ optics. Thinklogical routers allows for all critical system components including power supplies, cooling fans and pluggable optics (SFP+) to be hot-swappable. The hot-swappable I/O boards allow the router to be reconfigured without interrupting signal processing by powering down the router. In addition, the dual redundant power supplies ensure continuous, uninterrupted power. Thinklogical routers are controlled via an external Windows 7 computer. This allows for customization as well as ease of control and administration with access provided via a network connection (browser), or a serial port for 3rd party controller integration (such as Crestron, AMX or home-spun interfaces). Thinklogical's X4 Configurator is an advanced GUI which provides convenient user interface to the router from remote locations.

VEL-W00M08-LCTX: With Thinklogical's Velocity KVM extenders, you can centralize critical computing resources in a secure climate controlled machine room, and allocate them with our powerful (6.25 Gbps), long distance solutions that extend your KVM and serial devices up to 40 kilometers (24 miles) over multi-mode or single-mode fiber optics. Thinklogical KVM extenders fully support DVI (single link and dual-link), analog video, USB-HID, 2.0, serial, keyboard, mouse, CD quality audio extension. Firewire is optional. These extenders also feature: stereo emitter for active 3D applications, simple plug and play, a dry contact annunciator provides an alarm warning in the event of a power failure or a unit overheating, front panel status monitoring and control, they are also fully compatible with Velocity line. VelocityKVM System 8 supports one Dual-Link DVI display, PS2, USB 2.0, HID, full duplex stereo audio, and serial (RS-232).

VTM-U00004-LCTX: Velocity T-4200 Modular Chassis (VTS-004200) and Module (VTM-U00004-LCTX) are used to extend the computer video and user interfaces (keyboard and mouse, etc) over fiber optic cable. Thinklogical Velocitykvm T-4200 chassis is a high reliability, rack space saving solution. A 1U chassis size, with a dual interface and current sharing power supplies. The dual interface design provides for two separate interface modules and users have the ability to combine module options within one chassis. Available modules include Module 4 - One DVI display, Module 5 - One DVI or RGB display, Module 8 - One dual-link DVI display, Module 24 - Two DVI displays, SDI Xtreme 3G+ Module - Up to four SD/HD signals and up to

two 3G/dual-link signals and RS-422. Modules support: USB 2.0, HID and audio and fiber options include Multi-Mode and Single-Mode. These extenders also feature: stereo emitter for active 3D applications, simple plug and play, a dry contact annunciator provides an alarm warning in the event of a power failure or a unit overheating, front panel status monitoring and control, they are also fully compatible with Velocity line. The VTM-4 TX module supports one Single Link DVI, PS/2, Serial, HID, USB 2.0 and Audio.

VQM-0H0003-LCTX: Velocity Q-4300 Modular Chassis (VQS-004300) and Modules(VQM-0H0003-LCTX) are used to extend the Blu-Ray HDMI video over fiber optic cable. The Thinklogical Q-4300 chassis allows users to locate DVI and SDI monitors (via fiber) from just a few meters up to 40 kilometers away from the controlling computer, securely and without the loss of resolution. The Q-4300 is a rack space saving, high reliability solution providing a rack mount for up to 4 modules of DVI and/or SDI, dual USB HID and audio, single USB 2.0 and PS/2 interfaces or single USB 2.0 only, in a compact 1U chassis. Ready for the challenges of demanding applications, the Q-4300 can combine any variety of DVI and SDI modules, along with USB HID and audio in trasmit/receive units for a space saving and cost effective solution. Quad, hot-swappable interfaces: interface module options include- Q-Series Dual Peripheral Extension Module: Dual USB HID and Audio, Redundant USB HID and Audio module, USB 2.0 only module, USB 2.0, HID, PS/2 and Audio module -Velocitydvi, Module 3: One single-link DVI display, Velocitydvi Module 3 A/V+: One single-link DVI display, audio and serial, Velocitydvi Module 3 A/N+: One single-link DVI display, audio, Velocitydvi Module 6: One dual-link DVI display, Velocitydvi Module 6 A/V+: One dual-link DVI display, audio and serial, Velocitydvi Module 6 A/N+: One dual-link DVI display, audio, SDI Xtreme 3G+ Module: Two SD/HD signals or one 3G/dual-link signal and RS-422.   SDI Xtreme 3G+ 4K Module: Four SD/HD signals or two 3G/dual-link signal and RS-422. These extenders also feature: stereo emitter for active 3D applications, simple plug and play, a dry contact annunciator provides an alarm warning in the event of a power failure or a unit overheating, front panel status monitoring and control, they are also fully compatible with Thinklogical's Velocity line. Vel-3 HDCP Modules go into the Q4300 rackmount chassis. It is a single-link video extender that is HDCP compliant. It works with all HDCP enabled extenders and routers in the Velocity family.

VEL-AV0M12-LCTX: Thinklogical's DVI/RGB Extenders extend DVI and analog video signals up to 40 kilometers (24 miles) with standard video formats up to 1920 x 1200 to extend DVI and analog video. Options include balanced CD quality audio extension, and Neutrik® connection for rugged applications. These extenders are fully compatible with Velocity line. Velocity AV 12-The Velocityrgb System-12 supports one RGB display, full duplex stereo audio, and serial (RS-232) and it supports 480p, 720p, and 1080i component video.

SDC-000001-LC: The Thinklogical SDI to HDMI converter/extender allows you to seamlessly convert a broadcast quality SDI signal to HDMI. The SDI to HDMI converter is fully SMPTE compliant, including the active loop out port. System features include user SDI embedded audio conversion to HDMI output and remote control of the user interface via serial port (RS-232) and Ethernet port. The SDI to HDMI converter also has a fiber output option that is fully compatible with our Velocity line of receivers for a comprehensive conversion and extension solution.

HDC-000001-LC: The Thinklogical HDMI to SDI converter/extender allows you to seamlessly convert an HDMI or DVI signal to a broadcast quality SDI signal. The HDMI to SDI Converter is fully SMPTE compliant, and includes a genlock input. User interface options include a front panel LCD and encoder, and remote control via the serial port (RS-232) and Ethernet port. Audio inputs include HDMI embedded (up to eight channels), digital AES (single stereo pair) and balanced analog (single stereo pair). Audio outputs include SDI embedded (up to 8 channels). The HDMI to SDI converter also has a fiber output option that is fully compatible with our SDIXtreme 3G+ line of receivers for a comprehensive conversion and extension solution.

VEL-W00M08-LCRX: With Thinklogical's Velocity KVM extenders, you can centralize critical computing resources in a secure climate controlled machine room, and allocate them with our powerful (6.25 Gbps), long distance solutions that extend your KVM and serial devices up to 40 kilometers (24 miles) over multi-mode or single-mode fiber optics. Thinklogical KVM extenders fully support DVI (single link and dual-link), analog video, USB-HID, 2.0, serial, keyboard, mouse, CD quality audio extension. Firewire is optional. These extenders also feature- stereo emitter for active 3D applications, simple plug and play, a dry contact annunciator provides an alarm warning in the event of a power failure or a unit overheating, front panel status monitoring and control, they are also fully compatible with Velocity line.VelocityKVM System 8- supports one Dual-Link DVI display, USB 2.0, PS2, full duplex stereo audio, and serial (RS-232).

VTM-U00004-LCRX: The Thinklogical Velocitykvm T-4200 Modular Chassis and VTM Modules are a high reliability, rack space saving solution. A 1U chassis size, with a dual interface and current sharing power supplies. The dual interface design provides for two separate interface modules and users have the ability to combine module options within one chassis. Available modules include Module 4 - One DVI display, Module 5 - One DVI or RGB display, Module 8 - One dual-link DVI display, Module 24 - Two DVI displays, SDI Xtreme 3G+ Module - Up to four SD/HD signals and up to two 3G/dual-link signals and RS-422. Modules support: USB 2.0 and/or USB 1.0 HID and fiber options include Multi-Mode and Single-Mode. These extenders also feature- stereo emitter for active 3D applications, simple plug and play, a dry contact annunciator provides an alarm warning in the event of a power failure or a unit overheating, front panel status monitoring and control, they are also fully compatible with Velocity line.

VQM-HA0006-LCRX: The Q-4300 is a rack space saving, high reliability solution providing a rack mount for up to 4 modules of DVI and/or SDI, dual USB HID and audio in a compact 1U chassis. Ready for the challenges of demanding applications, the Q-4300 can combine any variety of DVI and SDI modules, along with USB HID and audio in trasmit/receive units for a space saving and cost effective solution. Quad, hot-swappable interfaces - interface module options include- Q-Series Dual Peripheral Extension Module: Dual USB HID and Audio, Redundant USB HID and Audio module, USB 2.0 only module, USB 2.0, HID, PS/2 and Audio module -Velocitydvi -Module 3: One single-link DVI display, Velocitydvi Module 3 A/V+: One single-link DVI display, audio and serial, Velocitydvi Module 3 A/N+: One single-link DVI display, audio, Velocitydvi Module 6: One dual-link DVI display, Velocitydvi Module 6 A/V+: One dual-link DVI display, audio and serial, Velocitydvi Module 6 A/N+: One dual-link DVI

display, audio, SDI Xtreme 3G+ Module: Two SD/HD signals or one 3G/dual-link signal and RS-422. These extenders also feature- stereo emitter for active 3D applications, simple plug and play, a dry contact annunciator provides an alarm warning in the event of a power failure or a unit overheating, front panel status monitoring and control, they are also fully compatible with Thinklogical's Velocity line.

VEL-0H0003-LCRX: Thinklogical's DVI/RGB Extenders extend DVI and analog video signals up to 40 kilometers (24 miles) with standard video formats up to 1920 x 1200 to extend DVI and analog video. Options include balanced CD quality audio extension, and Neutrik® connection for rugged applications. These extenders are fully compatible with Velocity line. Velocity 3 HDCP- is a single-link video extender that is HDCP compliant. It works with all extenders and routers in the Velocity family.

SDI-C100X1-LCRX: The SDI Xtreme+ 3G product series is a compact, broadcast quality, SDI over fiber extension system. The system is designed to transmit up to two SD/HD signals or one 3G SDI signal with or without embedded audio and data, and is SMPTE 424M, 292M, 259M, 372M and 425 level A and B compliant. In addition, this fiber based transport system gives users the assurance that each signal is immune to video pathological signals over the entire length of the fiber interconnect, while supporting all pathological patterns at all rates. The system also supports either single or multimode fiber, and is fully compatible with Thinklogical's Velocity line of products.

VQM-UAP001-LCTX: The Q-Series USB 2.0 Peripheral Extension Module VQM-UAP001-LCTX transmits USB 2.0, PS/2 interfaces and unbalanced audio connections. It works with all extenders and routers in the Velocity family.

VQM-UAP001-LCRX: The Q-Series USB 2.0 Peripheral Extension Module VQM-UAP001-LCRX receives USB 2.0, PS/2 interfaces and unbalanced audio connections. It works with all extenders and routers in the Velocity family.

X4 Control Program on Management Workstation: X4 is a web-based control system for Thinklogical's family of VX and MX routers. It runs on a separate Windows 7 computer and allows for easy configuration, management and control of any number of routers. The X4 Control Program on Windows 7 PC Platform will interface with the router using a private LAN connection. This connection is not to be connected to any other LAN and it will only be connected between the router and control platform located in a physically secure area. The X4 configurator allows for easy and intuitive setup and control of the switching between source computer or video entities and user display destinations. In addition, single video sources may be multi-cast (one to more than one) or broadcast (one to all) to desired destinations. Macro presets may be created for saving and recalling commonly used input and output ties. Log information can also be retrieved from the X4 configurator.

3. OPERATIONAL ARCHITECTURE. The Unified Capabilities (UC) architecture is a two-level network hierarchy consisting of Defense Information Systems Network (DISN) backbone switches and Service/Agency installation switches. The Department of Defense (DoD) Chief Information Officer (CIO) and Joint Staff policy and subscriber mission requirements determine

which type of switch can be used at a particular location. The UC architecture, therefore, consists of several categories of switches. Figure 2-1 depicts the Notional UC Network Architecture and Figure 2-2 depicts the UC VDS Reference Model.

4. TEST CONFIGURATION. The test team tested the SUT at SPAWAR UC APL Test Laboratory at St Juliens Creek, Portsmouth, Virginia in a manner and configuration similar to that of a notional operational environment. Testing of the system's required functions and features were conducted using the test configuration depicted in Figures 2-3. Information Assurance testing used the same configuration.

5. METHODOLOGY. Testing was conducted using VDS requirements derived from the Unified Capabilities Requirements (UCR) 2013, Errata 1, Reference (c), and VDS test procedures, Reference (d). Any discrepancy noted in the operational environment will be evaluated for impact on the existing certification. These discrepancies will be adjudicated to the satisfaction of DISA via a vendor Plan of Action and Milestones (POA&M), which will address all new critical Test Discrepancy Reports (TDRs) within 120 days of identification.
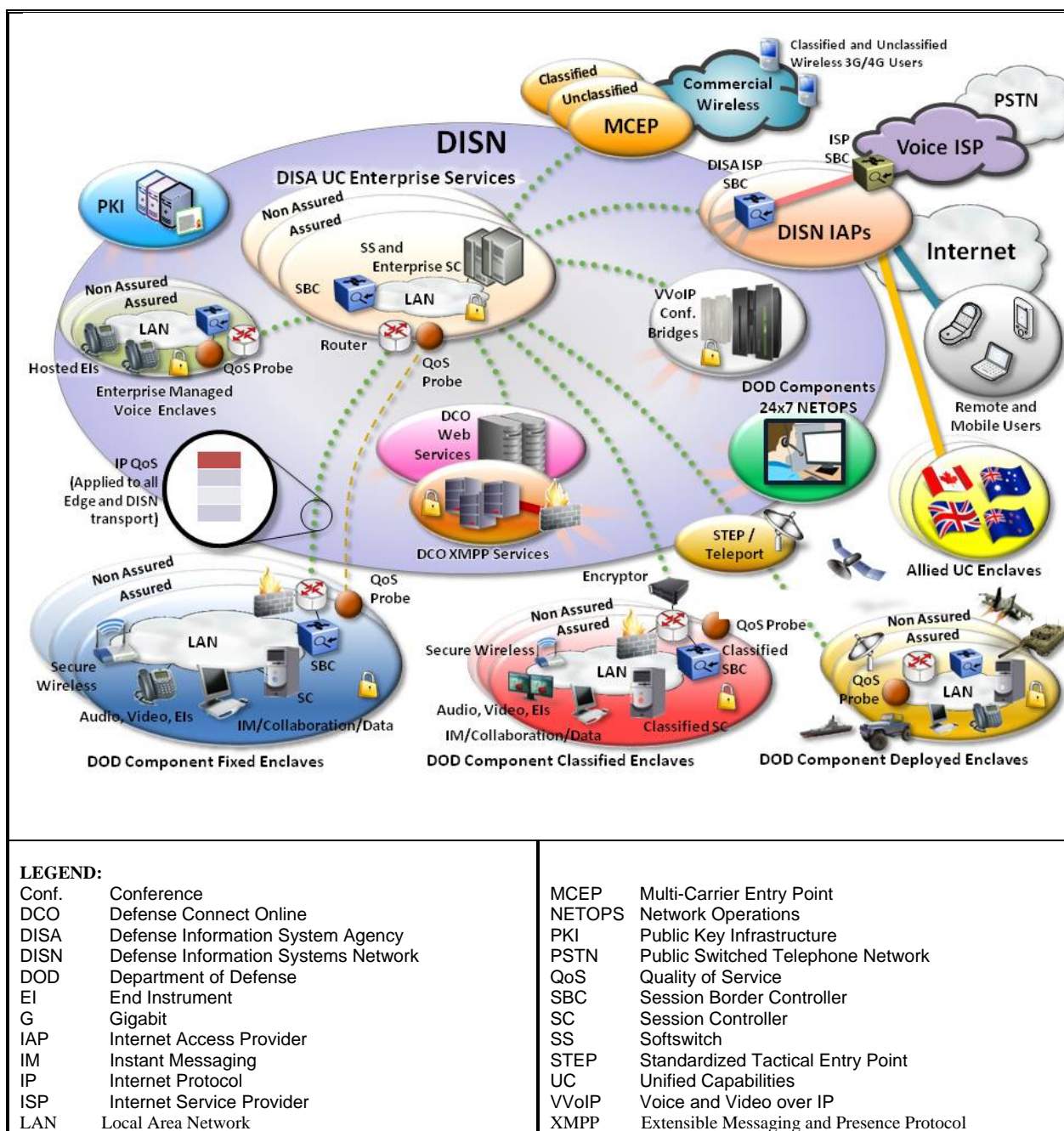
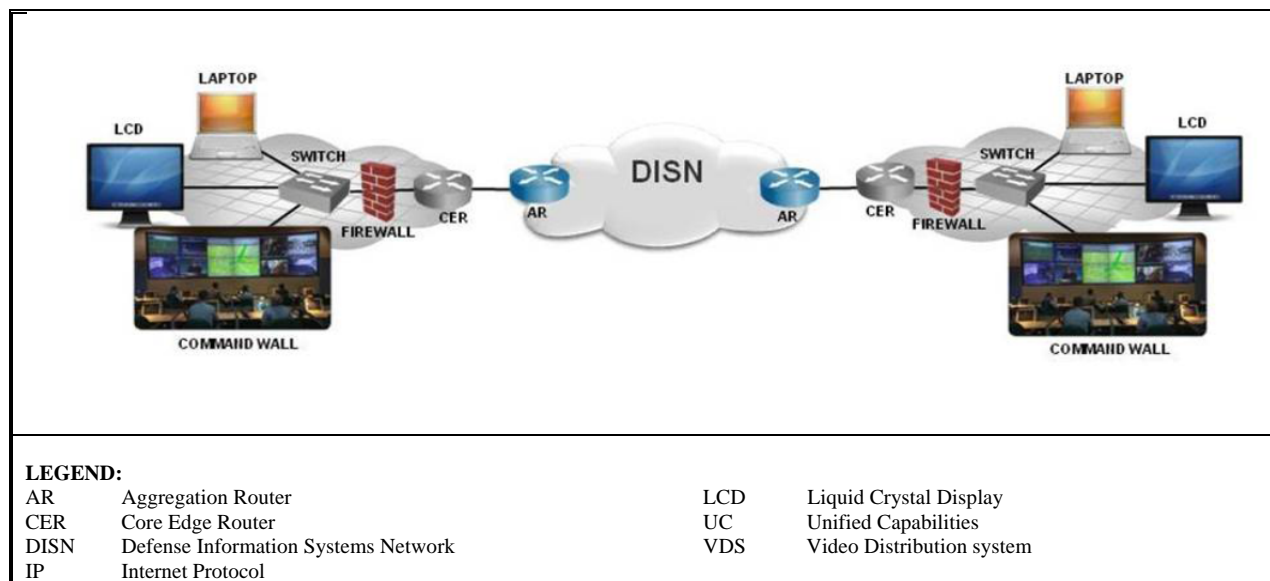**Figure 2-1. Notional UC Network Architecture**

2-7

LEGEND:

AR	Aggregation Router	LCD	Liquid Crystal Display
CER	Core Edge Router	UC	Unified Capabilities
DISN	Defense Information Systems Network	VDS	Video Distribution system
IP	Internet Protocol		

Figure 2-2. UC VDS Functional Reference Model

Figure 2-3. SUT Test Configuration

LEGEND:

3G	Third Generation	PC	Personal Computer
BD	Blu-ray Disc	R	Release
DISN	Defense Information Systems Network	Rev	Revision
DVD	Digital Video Disc	RGB	Red Green Blue
DVI	Digital Visual Interface	Rx	Receiver
HD	High Definition	SDI	Serial Digital Interface
HDMI	High Definition Multimedia Interface	SUT	System Under Test
KVM	Keyboard Video Mouse	TL	Thinklogical
LAN	Local Area Network	Tx	Transmitter
L1/K1/L3	Fiber Optic Cable	USB	Universal Serial Bus
L2/K2	Fiber Optic Cable	v	version
MS	Microsoft	VEL	Velocity

6. INTEROPERABILITY REQUIREMENTS, RESULTS, AND ANALYSIS. The interface, Capability Requirements (CR) and Functional Requirements (FR), IA, Internet Protocol version 6 (IPv6), and Requirements for security devices are established by UCR 2013, Errata 1, sections 9 and 7. Refer to Table 3-5 for a detailed list of requirements.

a. **Interface Requirements**

The SPAWAR UC APL testing interface status of the SUT is provided in Table 3-1. The SUT met the interface requirements with testing and the vendor's LoC. The SUT was tested and is certified with the following interfaces: HDMI, VGA, DVI, Multi-rate SDI, HD-SDI, and USB HID. The USB HID interface is an interface that supports High Definition video and audio. This is not a required interface. This interface was tested and is certified in a point-to-point configuration. This interface was not tested and is not certified over a local area network.

b. **Capability and Functional Requirements.** Table 3-2 provides the SUT CRs and FRs tested.

(1) Section 9.1, General VDS System. General VDS configuration requirements apply to all VDS devices in both the Closed VDS system configurations and VDS over Internet Protocol (IP) system configurations.

(a) The VDS system shall fall into one of two categories:

• Closed VDS System. These VDS systems are inaccessible from Department of Defense (DoD) IP-routed networks. Closed VDS systems shall follow the requirement as specified in the UCR 2013, Section 9.2. The SUT was tested and is certified as a Closed VDS System which is not accessible by IP routed networks, as depicted in Figure 2-3, which met this requirement.
• VDS over IP (VDS-IP) System. These are VDS systems that are accessible and interface with DoD IP-routed networks. VDS-IP systems shall follow the requirements as specified in the UCR 2013, Section 9.3. The SUT does not meet this requirement.

(b) If the Closed VDS system requires IP-routed control of its Matrix Switch, then the system shall utilize Out-of-Band Management (OBM) in accordance with the Security Technical Implementation Guidelines (STIGs). The SUT did not meet this requirement.

(c) The VDS system shall have the ability to be controlled from an external master control system. The SUT met this requirement with the vendor's LoC and testing. The SUT met this optional requirement with the use of the Crestron Touch Screen Matrix, which provides external control through an RS-232 interface.

(d) The VDS system shall provide at least one sub-control position with System Administrator permission access control. The SUT met this optional requirement.

1) **Section 9.1.1, IP Requirements for VDS Systems**

a) If the VDS system is inaccessible from DoD IP-routed networks, then the VDS system is considered a Closed VDS system and support of the IPv4 profile as defined in UCR 2013, Section 7.2.1.5, Protocols, and of the IPv6 profile as described in the UCR 2013, Section 5, IPv6, is optional. Otherwise, if the VDS systems connect to IP-routed networks, then

the VDS system is considered a VDS over IP system, and support of the IPv4 profile as defined in the UCR 2013, Section 5, IPv6, and of the IPv6 profile as described in the UCR 2013, Section 5, IPv6, is required. The SUT is a closed VDS system. Therefore, IPv4 and IPv6 are optional.

2) Section 9.1.2, VDS System Signal

a) The VDS system shall provide the ability to transfer audio and video signals in a variety of configurations, including, but not limited to, seat console to seat console, seat console to destination display device, seat console to video conversion device, seat console to VTC, and source devices to seat console. The SUT met this requirement with testing and the vendor's LoC. The SUT demonstrated this requirement by transferring audio and video signals in each of the configurations.

b) The VDS system shall be scalable for distributing incoming signal feeds from multiple video sources and shall route to multiple video display receivers as needed by operational requirements. The SUT met this requirement with testing and the vendor's LoC.

c) The VDS system shall be dynamic, transparent, and capable of understanding the capabilities of the display based on the input source, to provide the necessary equipment resolutions and information required by the peripheral equipment connected. The SUT met this requirement with testing and the vendor's LoC. The SUT met this requirement with testing, demonstrating the capability of using their source device and destination device for automatic detection.

d) The VDS system shall support both analog and digital input signals. This provides the flexibility to support both legacy analog sources and digital displays. The SUT met this requirement with the vendor's LoC.

e) The VDS system shall provide the ability to display signals from any source device to any compatible destination device, including intermediate display aggregators (e.g., Wall Controllers, Multi-View display processors). The SUT met this requirement with testing and the vendor's LoC. The SUT demonstrated this requirement by switching between source and destination devices and the switch matrix.

f) The VDS system shall maintain native audio and video signals from input interface to output interface without signal degradation, loss of data compression, color subsampling, frame rate conversion, auxiliary data loss or signal resolution formatting. The SUT met this requirement with testing and the vendor's LoC. The SUT demonstrated this with no noted degradation of voice quality on a subjective voice quality scale.

g) Any type of signal processing to modify the original audio or video signal information shall be documented and verified by maintenance and/or operator inquiry. The SUT met this requirement with the vendor's LoC.

h) The VDS system shall be capable of processing and maintaining a minimum of 4:2:2 chroma subsampling in color space, preserving single pixel detail through the

2-10 encoding, streaming, and decoding processes. The SUT met this requirement with the vendor's LoC.

i) The VDS system shall support internal scaling to allow the end user to specify different input or output resolutions as required, matching the configuration of installed equipment. The SUT met this requirement with testing and the vendor's LoC. The SUT demonstrated the capability to manage and control the source and destination device specifying different input and output resolutions to match existing external equipment.

j) The VDS system shall utilize VDS Peripheral Connector Conversion (VPCC) devices to modify audio and video signals to a single common interface standard for use in the VDS system. The SUT met this requirement with testing and the vendor's LoC. The specific VPCC devices are depicted in Table 3-3.

k) The VDS system shall provide methods to modify or customize EDID information reported to source devices in order to allow proper configuration of video source devices to match the overall capabilities of the VDS core switching, VDS destination devices, and display devices connected to the VDS system. The SUT met this requirement with the vendor's LoC.

l) The VDS system shall provide EDID signaling standard in accordance with the Video Electronics Standards Association (VESA) Enhanced Extended Display Identification, Version 1.3. The SUT met this requirement with the vendor's LoC.

3) Section 9.1.3, VDS System Peripheral

a) The VDS Peripherals shall fall into one of two categories in the subparagraphs below. The SUT is a destination device. The SUT includes both source device and destination devices internally.

• Source Devices. Signal generators that output video, audio and other waveforms which are used in the communication and synchronization of VDS subcomponents, using a signal type that is processed by the VDS Switch system. Examples include computer workstations, laptop computers, VTC codecs, video playback devices (DVD, Blu-ray, and media players), cable television tuners, and live video camera feeds.
• Destination Devices. Signal receivers that accept the signal from the VDS Switching system; process the video, audio, and other waveforms; and provide the necessary feedback that enables VDS. Examples include Desktop monitors, television monitors, video projectors, video signal processors, video recording devices, and video wall signal processor systems.

b) Destination devices shall support scan rates between 23.95 and 85Hz. The SUT met this requirement with the vendor's LoC.

c) Destination devices shall support video input resolutions of: 480i, 525i, 625i, 1080i, 480p, 720p, and 1080p for 50Hz and 60Hz progressive and interlaced scan formats.

The SUT met this requirement with the vendor's LoC.

d) Section 9.1.3 states that the Destination devices shall support video and picture graphics in their native resolution (without any visual artifacts), without additional processing and decoding, to maintain the original native resolution without use of image processing to resize or scale the original signal feed. The SUT met this requirement by testing and with the vendor's LoC.

4) Section 9.1.4, VDS Signal Extenders

a) The VDS Signal Extenders shall condition, amplify, and provide physical media conversion (i.e., copper to fiber optic or coaxial video to video over twisted pair) for audio and video signals to extend the maximum cabling distances from source devices to destination device. The SUT met this requirement in testing and with the vendor's LoC.

b) Section 9.1.4 states that the VDS Signal Extenders shall support, at a minimum, one of the following interconnects: coaxial, twisted pair, or fiber optical. The SUT met this requirement in testing and with the vendor's LoC. This was proved through coaxial and Optical Fiber interconnects.

5) Section 9.1.5, VDS System Peripheral Connectors

a) If the VDS system supports analog VGA and DVI computer connectors, then the formats in the following subparagraphs shall be supported. The SUT met this requirement with testing and the vendor's LoC.

• High Resolution [up to 1920x1200 pixels Wide Ultra eXtended Graphics Array (WUXGA)] computer video resolutions operating at up to 60Hz vertical refresh rate, or up to165 MHz total un-compressed pixel clock bandwidth.
• Analog VGA connectors with RGBHV, RGBS, or RGsB coaxial high definition video formats through use of RGBHV to VGA cabling adaptors.
• DVI connectors compatible with the Digital Display Working Group (DDWG) DVI 1.0 Specification, April 2, 1999.

b) If the VDS system supports Multi-Rate SDI connectors, then the Society of Motion Picture and Television Engineers (SMPTE) formats in the following subparagraphs shall be supported. The SUT supports this conditional requirement.
• SMPTE 259M: Standard Definition SDI (SD-SDI)
• SMPTE 344M: Enhanced Definition SDI (ED-SDI)
• SMPTE 292M: High Definition SDI (HD-SDI)
• SMPTE 424M: 3-Gbps SDI (3G-SDI)
• SMPTE 291M: Ancillary Data Packet and Space Formatting

c) If the VDS system supports HDMI video connectors and provides support for digital video sources with and without High-Bandwidth Digital Content Protection (HDCP) copy protection, then the HDMI features in the following subparagraphs shall be supported. The

SUT met this requirement with the vendor's LoC.

• High-resolution (up to 1920x1200 pixels WUXGA) computer video resolutions operating at up to 60Hz vertical refresh rate, or up to165MHz total un-compressed pixel clock bandwidth.
• 24-bit color pixel depth and RGB and YCbCr color space.
• Embedded 2 CH Stereo Uncompressed Pulse Code Modulation (PCM) audio signaling over HDMI interface connections.

d) Section 9.1.5 states that the VDS system shall support EDID for VGA, DVI, and HDMI connectors. EDID support shall be provided by a VDS connector to describe the capabilities of the VDS system interface to a connected video source device. EDID interface signaling provided by the VDS to the source video device shall include the components in the following subparagraphs. The SUT met this requirement with the vendor's LoC.

• VDS Manufacture ID
• VDS Product Identification
• Digital or analog capability of VDS Interface
• Supported video resolution and video timing modes of the VDS system
• Preferred video resolution and video timing mode of the VDS system

6) Section 9.1.6, VDS Peripheral Connectors Conversion Devices

a) VPCCs shall accept, couple, and convert from input to output for connector peripherals. The SUT met this requirement with testing and the vendor's LoC.

b) VPCCs shall accept high-resolution, up to 1920x1200 pixels WUXGA computer video resolutions, operating at up to 60Hz vertical refresh rate, or up to165MHz total un-compressed pixel clock bandwidth. The SUT met this requirement with the vendor's LoC.

c) VPCCs shall support upwards and downwards video resolution and frame rate signal processing. The SUT met this requirement with the vendor's LoC.

d) VPCCs shall use video scaling or signal processing to convert between different connector peripherals. The SUT met this requirement with the vendor's LoC.

e) VPCCs shall allow for dynamic conversion or for user-defined conversions to support display resolution formats with varying aspect ratios (4:3, 16:9, and 16:10). The SUT met this requirement with the vendor's LoC.

f) If the VPCCs require local monitoring, then VPCCs shall support local HD-SDI/VGA/DVI/HDMI loop-through outputs (as needed for the video source format) for local monitoring. The SUT met this conditional requirement.

g) VPCCs shall auto-detect the type of peripheral present and provide video peripheral conversion and processing as needed to match the selected video peripheral of the

attached video display or VDS subcomponent. The SUT met this requirement with the vendor's LoC and in testing.

h) VPCCs shall support Ethernet management interfaces for diagnostic information and control, including the information in the following subparagraphs. The SUT support this requirement between the Matrix Router and the workstation as this is the only Ethernet interface.

- Complete information about the device
- Physical identification of hardware and system error log

7) **Section 9.1.7, VDS Master Control Switch**

a) The VDS Master Control switch shall allow the end user to select and verify the processing of any signal displayed. The SUT met this requirement through demonstration and with the vendor's LoC.

b) The VDS Master Control switch shall be able to perform the functions in the following subparagraphs on the VDS Matrix Switch. The SUT met this requirement with testing and the vendor's LoC.

- Switch Single Input to Single Output. The SUT met this requirement with testing and the vendor's LoC.
- Switch Single Input to Multiple Outputs. The SUT met this requirement with testing and the vendor's LoC.
- Allow the user to "record" and "recall" presets of crosspoint routings over both the entire switch matrix and selected groupings of inputs and outputs. The SUT met this requirement through demonstration and with the vendor's LoC.

c) The VDS Master Control shall be able to perform the functions in the following subparagraphs on the VDS Matrix Switch. The SUT met this requirement with testing and the vendor's LoC.

- Switch Single Input to Single Output. The SUT met this requirement with testing and the vendor's LoC.
- Switch Single Input to Multiple Outputs.
- Enquire the status of any current configuration, by individual output, resulting in the current routed input information; by individual input, resulting in a listing of all current outputs; a master listing of all input names (if stored within the device); and a master listing of all current output assignments. The SUT met this requirement with the vendor's LoC.
- Clear the switching or crosspoint (route "0") based on input, where any output with the selected input will be automatically cleared, or based on output, where only the selected output crosspoints are cleared. Clearing must result in NO INPUT selected rather than using a "blank" or "un-assigned" input. The SUT met this requirement with the vendor's LoC.

8) Section 9.1.8, VDS Matrix Switch

a) The VDS Matrix Switch shall accept original audio and video signals, VDS System Signal, and shall accept multiple connectors, VDS Signal Extenders, to interface to other VDS Matrix Switching Devices, VDS Distribution Devices, VDS Switching Devices, VDS Conversion Devices, and other VDS subcomponents. The SUT met this requirement with testing and the vendor's LoC.

b) The VDS Matrix Switch shall support hot-swappable expansion modules. The SUT met this requirement with the vendor's LoC.

c) The VDS Matrix Switch shall support local and remote control management and control. The SUT met this requirement with testing and the vendor's LoC.

d) The VDS Matrix Switch shall include a local primary control mode that supports a secondary external control mode as needed for redundancy. The SUT met this requirement with the vendor's LoC.

e) If the VDS Matrix Switch is slated for specialized missions, the VDS Matrix Switch shall use custom rack mounts (e.g., Ship board operations). Otherwise, the VDS Matrix Switch shall support the industry standard 19-inch wide equipment racks. The SUT met this requirement with the vendor's LoC and in demonstration.

f) If the VDS Matrix Switch is slated for mission-critical C2 operations, then the VDS Matrix Switch shall include two or more hot-swappable power supplies with two independent power cords for redundancy. The SUT does not support this optional requirement.

g) The VDS Matrix Switch shall provide at least one sub-control position with System Administrator permission access control. The SUT met this requirement with testing and the vendor's LoC. The management workstation is used to configure administrator and users permissions control.

9) Section 9.1.9, VDS IA Security

a) All VDS components shall adhere to the appropriate STIGs. The SUT met this requirement with the vendor's LoC and testing. Security testing is led by DISA-led IA test teams and the results published in a separate report.

b) All VDS components shall meet all appropriate Ports, Protocols, and Services Management (PPSM) guidelines and vulnerability and risk assessments to achieve compliance for all information systems, applications, and services connected to the Global Information Grid (GIG). The SUT met this requirement with the vendor's LoC and testing. Security testing is led by DISA-led IA test teams and the results published in a separate report.

c) The VDS shall meet all appropriate Information Assurance (IA) and Vulnerability Assessment (IAVA) and National Institute of Standards and Technology

(NIST)/National Information Assurance Partnership (NIAP) standards. The SUT met this requirement with the vendor's LoC and testing. Security testing is led by DISA-led IA test teams and the results published in a separate report.

10) Section 9.1.10, VDS Availability

a) Section 9.1.10 states that the number of UI events shall be no more than 4.38 events per year. The SUT met this requirement with the vendor's LoC.

b) Section 9.1.10 states that the duration of unscheduled interruption (DUI) events shall be no more than 2 hours per event. The SUT met this requirement with the vendor's LoC.

c) Section 9.1.10 states that the duration of scheduled outages shall be no longer than 0.5 hours per month and 6 hours per year. The SUT met this requirement with the vendor's LoC.

d) Section 9.1.10 states that all outages or service disruptions to the system shall be correctable within 2 hours using normal maintenance procedures. The SUT met this requirement with the vendor's LoC.

11) Section 9.1.11, VDS Diagnostics

a) Section 9.1.11 states that the VDS Matrix Switch, VPCCs, and VDS signal Extenders shall provide system diagnostics to verify and validate proper system operation and status. The SUT met this requirement with testing and the vendor's LoC. This was accomplished by an SNMP print out for the Matrix Control Switch (MXR-00048-FM). Also, accessing each signal extender and VPCC gave diagnostic information of various areas of the system.

b) Section 9.1.11 states that the VDS Matrix Switch shall provide complete information about the device, including all software and firmware revisions; type of device; model number; IP address; serial number; MAC address; input signal resolution; original signal resolution; physical location of the unit (based on customer input at time of installation); internal temperatures of the unit; fan speed and status of each fan associated with the unit; and an error log pertaining to the unit. The VDS Matrix Switch (MX-48 Router) was unable to identify input and original signal resolution. A TDR was generated and was adjudicated as a change requirement. A change of optional or conditional was recommended by the adjudication board to this UCR requirement.

c) Section 9.1.11 states that the VPCCs and VDS signal Extenders shall be able to output an internally generated video signal in place of the input signal and an audio tone in place of the incoming audio. The SUT partially met this requirement with testing and the vendor's LoC.

d) Section 9.1.11 states that the VDS Matrix Switch, VPCCs, and VDS signal Extenders shall provide an interface capability to be monitored from a centralized monitoring and diagnostic VDS control location. The SUT met this requirement with the vendor's LoC and in testing.

e) Section 9.1.11 states that the VDS Matrix Switch, VPCCs, and VDS signal Extenders shall support local and remote control. The SUT met this requirement with testing and the vendor's LoC. The Matrix Switch demonstrated local and remote control. The SUT does not have a device or method present to support remote control diagnostics or operation of VPCCs and Signal Extenders. A TDR was generated and was adjudicated as a change requirement. The change requirement recommended the UCR requirement to be conditional and based on specified remote distances.

(2) Section 9.2, Closed VDS System

(a) Closed VDS Systems shall comply with the General VDS System Requirements as outlined in Section 9.1, General VDS System. The SUT met this requirement with testing and the vendor's LoC as noted in paragraph 6.b.(1).

(b) Closed VDS Systems shall support the IPv4 profile as defined in Section 7.2.1.5, Protocols, and the IPv6 profile as described in Section 5, IPv6. IPv4 is not required for a closed VDS system. IPv6 is not supported and is not required.

(c) Closed VDS Systems shall interface with a VDS Matrix Switch controller. The SUT met this requirement with testing and the vendor's LoC. The Matrix Controller is identified as MXR-00048-FM.

(d) Closed VDS Systems shall support serial RS-232, RS-422, or RS-485 interfaces as required by the system. Although the vendor's LoC states compliance to these serial interfaces, only RS-232 was tested for use to manage the system.

(e) Closed VDS Systems shall support USB and Ethernet interfaces. The SUT met the requirement for USB interfaces with testing. The USB HID interface is an interface that support High Definition video and audio. This is not a required interface. This interface was tested and is certified in a point-to-point configuration only on a closed and logically separated network.

(f) Closed VDS Systems shall support a web-based configuration and control. The SUT met this requirement with the vendor's LoC.

(3) Section 9.3, VDS Over IP (VDS-IP). The requirements in the subparagraphs below do not apply to the SUT.

(a) VDS-IP Systems shall comply with the General VDS System Requirements as outlined in Section 9.1, General VDS System.

(b) VDS-IP Systems shall support the IPv4 profile as defined in Section 7.2.1.5, Protocols, and the IPv6 profile as described in Section 5, IPv6.

(c) If the VDS-IP system uses standards-based video or picture conversion, compression, and encoding methods, then the VDS system shall be categorized as an Open Distribution VDS System. Otherwise, the system is a Proprietary Distribution VDS System.

(d) VDS-IP Codecs shall use MPCA and/or PCA formats based on mission objectives.

(e) Open Distribution VDS-IP systems shall comply with all Unified Capabilities (UC) Audio and Video Conference System Requirements as defined in Section 3.4, UC Audio and Video Conference System.

(f) Proprietary Distribution VDS-IP systems shall comply with all IP Transport and Proprietary Codec requirements as defined in the UC Audio and Video Conference System Requirements as defined in Section 2.6, SC and SS Failover.

(g) VDS-IP Systems shall comply with the following PCA formats:

- JPEG, JPEG2000, VC-1, Dirac, VP8 or other compression codecs based on Discrete Cosine Transform (DCT) or Discrete Wavelet Transform (DWT).
- PNG

(h) VDS-IP subcomponents shall support serial RS-232, USB, or Ethernet.

(i) VDS-IP systems shall support a web-based configuration and control.

(j) VDS-IP systems shall interface with a VDS Matrix Switch controller.

1. Section 9.3.1, VDS–IP Codec

a. VDS-IP shall fall into one of two categories: VDS-IP Hardware Codec or VDS-IP Software Codec.

b. VDS-IP Hardware Codecs shall accept computer graphic input resolutions to include VGA, SVGA, XGA, SXGA, SXGA+, UXGA, WUXGA, 1920x1080, and custom computer graphic resolutions and input modes.

c. The VDS-IP Hardware Codecs shall provide reliable decoding during live configuration changes or selection of new active audio and video data streams (e.g., decoding device does not require restart, resync, or reboot to acquire newly selected data stream).

(4) Section 9.4, VDS Recording. The requirements in the subparagraphs below do not apply to the SUT.

(a) VDS Recording Devices shall fall into one of two categories:

- Video Tape Recorder (VTR). A device that captures and archives video and/or audio material on a magnetic tape (e.g.,video tape, compact cassette).
- Digital Video Recorder (DVR). A device or application software that captures and archives video and/or audio in a digital format to a disk drive, USB flash drive, Standard Definition (SD) memory card, or other local or networked mass storage device.

(b) VTR Recording Devices shall adhere to the requirements specified in Section 9.4.1, VDS Video Tape Recording (VTR).

(c) DVR Recording Devices shall adhere to the requirements specified in Section 9.4.2, VDS Digital Video Recording (DVR).

1. Section 9.4.1, VDS Video Tape Recording (VTR)

a. VTR devices shall accept standard and high-definition video using the following SMPTE formats:

- SMPTE 259M: SD-SDI
- SMPTE 344M: ED-SDI
- SMPTE 292M: HD-SDI
- SMPTE 424M: 3G-SDI
- SMPTE 291M: Ancillary Data Packet and Space Formatting

b. VTR devices shall accept standard and high-definition video using the following SMPTE formats:

- SMPTE 372M: Dual-Link (DL) HD-SDI
- Digital Picture Exchange

2. Section 9.4.2, VDS Digital Video Recording (DVR)

a. DVR devices shall be capable of recording and replaying video and audio using MPCA and Audio Compression Algorithms (ACAs) as defined in Section 3.4, UC Audio and Video Conference System, and shall be able to capture Picture Compression Algorithms (JPEG and PNG).

b. DVR devices shall be capable of recording and replaying video using MPEG-4 Part 2, MPEG-2 .mpg, MPEG-2 .TS, VOB, and International Organization for Standardization (ISO) video.

c. DVR devices shall be capable of recording and replaying audio using MP3, AC3, and Ogg.

d. DVR devices shall integrate with the monitor and/or TV set.

e. DVR devices shall be VESA compatible.

f. DVR devices shall be able to interface with PC-based compatible devices running Microsoft Windows, Linux, or Mac OS.

(5) Section 7.2.1.6, Quality of Service Features for IP Interfaces. Products that support IP interfaces shall support the DSCP plan, as shown in UCR 2013 Table 7.2-3. Differentiated Services (DS) assignments shall be software configurable for the full range of six bit values (0-63 Base10). RFC 2474 defines the DS field. In IPv4, it defines the layout of the Type of Service (TOS) octet. In IPv6, it defines the layout in the Traffic Class octet. The SUT does not support this requirement; therefore, this requirement does not apply to the SUT.

c. Hardware/Software/Firmware Version Identification. Table 3-3 provides the SUT components' hardware, software, and firmware tested. The SPAWAR UC APL Test Laboratory tested the SUT in an operationally realistic environment to determine its interoperability capability with associated network devices and network traffic. Table 3-4 provides the hardware, software, and firmware of the components used in the test infrastructure.

7. TESTING LIMITATIONS. None.

8. CONCLUSION(S). The SUT meets the interoperability requirements for a UC VDS in accordance with the UCR 2013. The SUT meets the interoperability requirements for the interfaces listed in Table 3-1.

DATA TABLES

Table 3-1. Interface Status

Interface	Threshold CR/FR Requirements (See note 1.)	Status	Remarks
Closed VDS Interfaces			
Serial (TIA-232) (C)	1, 2, 4	Not Tested	See note 2.
Serial (TIA/EIA-422) (C)	1, 2, 4	Not Tested	See note 2.
Serial (EIA-485) (C)	1, 2, 4	Not Tested	The SUT does not support this conditional interface.
HDMI (C)	1, 2, 4	Met	
VGA (C)	1, 2, 4	Met	
DVI (C)	1, 2, 4	Met	
Multi-rate SDI (C)	1, 2, 4	Met	
HD-SDI (C)	1, 2, 4	Met	
USB HID (C)	1, 2, 4	Met	See note 3.
VDS-IP Interfaces			
Serial (TIA-232) (C)	1, 3, 4, 5	Not Tested	The SUT is a closed VDS; therefore, this does not apply.
10Base-X (C)	1, 3, 4, 5	Not Tested	The SUT is a closed VDS; therefore, this does not apply.
100Base-X (C)	1, 3, 4, 5	Not Tested	The SUT is a closed VDS; therefore, this does not apply.
1000Base-X (C)	1, 3, 4, 5	Not Tested	The SUT is a closed VDS; therefore, this does not apply.
Management Interfaces			
Serial (TIA-232) (C)	1, 5	Met	
10/100/1000BaseT (C)	1, 5	Met	See note 4.

NOTES:
1. The SUT high-level CR and FR ID numbers depicted in the Threshold CRs/FRs column can be cross-referenced in Table 3. These high-level CR/FR requirements refer to a detailed list of requirements provided in Enclosure 3.
2. Closed VDS Systems shall support serial RS-232, RS-422, or RS-485 interfaces as required by the system. Although the vendor's LoC states compliance to these serial interfaces, only the RS-232 was tested and certified for use to manage the system.
3. The USB HID interface is an interface that supports High Definition video and audio. This is not a required interface. This interface was tested and is certified in a point-to-point configuration. This interface was not tested and is not certified over a local area network.
4. The 10BaseT interface is used by a workstation located in a logically and physically separated VDS System. SPAWAR analysis determined that the 10BaseT interface is a low risk for certification based on testing and complies with the IEEE 802.3i standard and the testing data collected at all other data rates.

LEGEND:

Base-T	Ethernet generic designation (Baseband)	LoC	Letter of Compliance
C	Conditional	RS	Recommended Standard
CR	Capability Requirements	SDI	Serial Digital Interface
DVI	Digital Visual Interface	SPAWAR	Space and Naval Warfare Center
EIA	Electronic Industries Alliance	SUT	System Under Test
FR	Functional Requirements	TIA	Telecommunications Industry Association
HD	High Definition	UCR	Unified Capabilities Requirements
HDMI	High Definition Multimedia Interface	USB	Universal Serial Bus
HID	Human Interface Device	VDS	Video Distribution System
IEEE	Institute of Electrical and Electronics Engineers	VGA	Video Graphics Array

Table 3-2. Capability and Functional Requirements and Status

CR/FR ID	Capability/ Function	Applicability (See note 1.)	UCR 2013 Reference	Status (See note 2.)	Remarks
	General VDS System				
1	IP Requirements for VDS System	Optional	9.1.1	Not Tested	(See note 4.)
	VDS System Signal	Required	9.1.2	Met	
	VDS System Peripheral	Optional	9.1.3	Met	
	VDS Signal Extenders	Required	9.1.4	Met	
	VDS System Peripheral Connectors	Conditional	9.1.5	Met	

Enclosure 3

Table 3-2. Capability and Functional Requirements and Status (continued)

	VDS Peripheral Connector Conversion Devices	Required	9.1.6	Met	
	VDS Master Control Switch	Required	9.1.7	Met	
	VDS Matrix Switch	Required	9.1.8	Met	
	VDS IA Security (See note 3)	Required	9.1.9	Met	
	VDS Availability	Required	9.1.10	Met	
	VDS Diagnostics	Required	9.1.11	Met	(See notes 5,6.)
2	**Closed VDS System**				
	Closed VDS System Requirements	Required	9.2	Met	
3	**VDS over IP (VDS-IP)**				
	VDS-IP Codec	Required	9.3.1	Not Tested	(See note 4.)
4	**VDS Recording**				
	VDS Video Tape Recording (VTR)	Required	9.4.1	Not Tested	(See note 4.)
	VDS Digital Video Recording (DVR)	Required	9.4.2	Not Tested	(See note 4.)
5	**Quality of Service**				
	Quality of service features for IP interfaces	Required	7.2.1.6	Not Tested	(See note 4.)

NOTES:
1. The annotation of 'required' refers to a high-level requirement category. The applicability of each sub-requirement is provided in Enclosure 3; Table 3-1 provides detailed CR/FR for VDS.
2. The results of the requirements for each UCR 2013 referenced section,
3. Security is tested by SPAWAR-led Information Assurance test teams and the results published in a separate report, Reference (e).
4. The SUT does not support this requirement and it is not required for a closed VDS.
5. The VDS Matrix Switch (MX-48 Router) was unable to identify input and original signal resolution.. A TDR was generated and was adjudicated as a change requirement. A change of optional or conditional was recommended by the adjudication board to this UCR requirement.
6. The SUT does not have a device or method present to support remote control diagnostics or operation of VPCCs and Signal Extenders. A TDR was generated and was adjudicated as a change requirement. The change requirement recommended the UCR requirement to be conditional and based on specified remote distances.

LEGEND:
CR	Capability Requirement	SPAWAR	Space and Naval Warfare Command
DVR	Digital Video Recording	SUT	System Under Test
FR	Functional Requirement	TDR	Test Discrepancy Report
ID	Identification	UCR	Unified Capabilities Requirements
IP	Internet Protocol	VDS	Video Distribution System
		VTR	Video Tape Recording

Table 3-3. SUT Hardware/Software/Firmware Version Identification

Component (See Note 1.)	Release	Sub-component	Function
MXR-00048-FM, MXR-000048-FM REV B, MXR-000048-RM, MXR-000048-RM REV B, MXR-000048-SA, MXR-000048-SA REV B, MXR-000E48, MXR-000E48-FM, MXR-000E48-RM, MXR-000E48-SA, MXR-000S48, MXR-000S48-FM, MXR-000S48-RM, MXR-000S48-SA, MXR-A00048-SA	Linux 2.6.25.10.atmel.2 BusyBox v1.12.1	Not Applicable	VDS Matrix Switch
VEL-W00M08-LCTX, VEL-W00M08-LCRX, VEL-AV0M12-LCTX, VEL-0H00003-LCRX, VTS-004200, VTM-U00004-LCTX, VTM-U00004-LCRX, VQS-004300, VQM-0H0003-LCTX, VQM-HA0006-LCRX, VQM-UAP001-LCTX, VQM-UAP001-LCRX, SDC-000001-LC, HDC-000001-LC, SDI-C100X1-LCRX	Firmware Version v1.01 Firmware Version v2.0 Firmware Version v20.04 Firmware Version v21.12 Firmware Version v22.12 Firmware Version v22.13 Firmware Version v51.20 Firmware Version v52.11	Not Applicable	VDS Signal Extenders
MXM-000004	Firmware v1.01	Not Applicable	Master Control Switch
Site-Provided, STIG-compliant Computer	Microsoft Windows 7	Not Applicable	Management Workstation

Table 3-3. SUT Hardware/Software/Firmware Version Identification (continued)

NOTES:
1. Components bolded and underlined were tested by SPAWAR. The other components in the family series were not tested but are also certified for joint use by similarity. SPAWAR certifies those additional components because they utilize the same software/ firmware and similar hardware. SPAWAR analysis determined them to be functionally identical for interoperability certification purposes.

LEGEND:

APL	Approved Products List	SPAWAR	Space and Naval Warfare Center
DoD	Department of Defense	SUT	System Under Test
JITC	Joint Interoperability Test Command	STIG	Security Technical Implementation Guides
MXR	Matrix Router	TX	Transmit
OS	Operating System	UC	Unified Capabilities
RX	Receive	VDS	Video Distribution System

Table 3-4. Test Infrastructure Hardware/Software/Firmware Version Identification

System Name	Software Release	Function
Required Ancillary Equipment		
None Required		
Test Network Components		
Laptop Computer	MS Windows 7 Enterprise SP1	Source
Cyber Acoustics Speakers 3201	NA	Audio Receiver
Panasonic DMP-BDT500	NA	Source (Blue Ray Player)
Sony BPP-5300	NA	Source (Blue Ray Player)
Shimian QH2700-IPSMSDP	NA	Display Monitor
JVC DT-V20L1D	NA	Display Monitor
NEC EA243WM-BK	NA	Display Monitor
NEC EA244WMi-BK	NA	Display Monitor
Sceptre X20	NA	Display Monitor
Phabrix SX	NA	Source (SDI Gen/ Analyzer)
Memorex 32023223	NA	Source (USB DVD Player)

LEGEND:

DVD	Digital Video Disc	SP1	Service Pack 1
MS	Microsoft	SDI	Serial Digital Interface
NA	Not Applicable	USB	Universal Serial Bus

Table 3-5. UC VDS Capability/Functional Requirements

CR/FR ID	Requirement	UCR Ref (UCR 2013)	R/O/C
1	General VDS System		
1-1	The VDS system shall fall into one of two categories: a. Closed VDS System. These are VDS systems that are inaccessible from Department of Defense (DoD) IP-routed networks. Closed VDS systems shall follow the requirements as specified in Section 9.2, VDS System. b. VDS over IP (VDS-IP) System. These are VDS systems that are accessible and interface with DoD IP-routed networks. VDS-IP systems shall follow the requirements as specified in Section 9.3, VDS over IP (VDS-IP). NOTE: This section leverages the DoD Architecture Framework (DoDAF) baseline for a Closed System; therefore, the VDS shall be Closed if the system is inaccessible from external networks such as Non-Secure Internet Protocol Router (NIPR) or Secure Internet Protocol Router (SIPR).	9.1 VDS-000010	R
1-2	If the Closed VDS System requires IP-routed control of its Matrix Switch, then the system shall utilize Out-of-Band Management (OBM) in accordance with the Security Technical Implementation Guidelines (STIGs).	9.1 VDS-000020	C
1-3	The VDS system shall have the ability to be controlled from an external master control system.	9.1 VDS-000030	O
1-4	The VDS system shall provide at least one sub-control position with System Administrator permission access control.	9.1 VDS-000040	O
2	IP Requirements for VDS Systems		
2-1	If the VDS system is inaccessible from DoD IP-routed networks, then the VDS system is considered a Closed VDS System, and support of the IPv4 profile as defined in Section 7.2.1.5, Protocols, and of the IPv6 profile as described in Section 5, IPv6, is optional. Otherwise, if the VDS systems connect to IP-routed networks, then the VDS system is considered a VDS over IP System, and support of the IPv4 profile as defined in Section 5, IPv6, and of the IPv6 profile as described in Section 5, IPv6, is required.	9.1.1 VDS-000050	O
3	VDS System Signal		
3-1	The VDS system shall provide the ability to transfer audio and video signals in a variety of configurations, including, but not limited to, seat console to seat console, seat console to destination display device, seat console to video conversion device, seat console to VTC, and source devices to seat console.	9.1.2 VDS-000060	R
3-2	The VDS system shall be scalable for distributing incoming signal feeds from multiple video sources and shall route to multiple video display receivers as needed by operational requirements.	9.1.2 VDS-000070	R
3-3	The VDS system shall be dynamic, transparent, and capable of understanding the capabilities of the display based on the input source, to provide the necessary equipment resolutions and information required by the peripheral equipment connected.	9.1.2 VDS-000080	R
3-4	The VDS system shall support both analog and digital input signals. This provides the flexibility to support both legacy analog sources and digital displays.	9.1.2 VDS-000090	R
3-5	The VDS system shall provide the ability to display signals from any source device to any compatible destination device, including intermediate display aggregators (e.g., Wall Controllers, Multi-View display processors).	9.1.2 VDS-000100	R
3-6	The VDS system shall maintain native audio and video signals from input interface to output interface without signal degradation, loss of data compression, color sub-sampling, frame rate conversion, auxiliary data loss or signal resolution formatting.	9.1.2 VDS-000110	R
3-7	Any type of signal processing to modify the original audio or video signal information shall be documented and verified by maintenance and/or operator inquiry.	9.1.2 VDS-000120	R
3-8	The VDS system shall be capable of processing and maintaining a minimum of 4:2:2 chroma subsampling in color space, preserving single pixel detail through the encoding, streaming, and decoding processes.	9.1.2 VDS-000130	R
3-9	The VDS system shall support internal scaling to allow the end user to specify different input or output resolutions as required, matching the configuration of installed equipment.	9.1.2 VDS-000140	R

CR/FR ID	Requirement	UCR Ref (UCR 2013)	R/O/C
3-10	The VDS system shall utilize VDS Peripheral Connector Conversion (VPCC) devices (Section 9.1.3, VDS System Peripheral) to modify audio and video signals to a single common interface standard for use in the VDS system. NOTE: Possible applications of this method would convert high-resolution computer graphics DVI interfaces to production television HD-SDI interface formats for switching and distribution. These HD-SDI signaling interface formats are then typically converted back to DVI or HDMI interfaces for use with common display devices.	9.1.2 VDS-000150	R
3-11	The VDS system shall provide methods to modify or customize EDID information reported to source devices in order to allow proper configuration of video source devices to match the overall capabilities of the VDS core switching, VDS destination devices, and display devices connected to the VDS system.	9.1.2 VDS-000160	O
3-12	The VDS system shall provide EDID signaling standard in accordance with the Video Electronics Standards Association (VESA) Enhanced Extended Display Identification, Version 1.3.	9.1.2 VDS-000170	O
4	VDS System Peripheral		
4-1	VDS Peripherals shall fall into one of two categories: a. Source Devices. Signal generators that output video, audio and other waveforms which are used in the communication and synchronization of VDS subcomponents, using a signal type that is processed by the VDS Switch system. Examples include computer workstations, laptop computers, VTC codecs, video playback devices (DVD, Blu-ray, and media players), cable television tuners, and live video camera feeds. b. Destination Devices. Signal receivers that accept the signal from the VDS Switching system; process the video, audio, and other waveforms; and provide the necessary feedback that enables VDS. Examples include Desktop monitors, television monitors, video projectors, video signal processors, video recording devices, and video wall signal processor systems. NOTE: Some devices, such as VTC codecs and recording devices, may serve as a source and/or destination device.	9.1.3 VDS-000180	O
4-2	Destination devices shall support scan rates between 23.95 and 85 Hz.	9.1.3 VDS-000190	O
4-3	Destination devices shall support video input resolutions of: 480i, 525i, 625i, 1080i, 480p, 720p, and 1080p for 50 Hz and 60 Hz progressive and interlaced scan formats.	9.1.3 VDS-000200	O
4-4	Destination devices shall support video and picture graphics in their native resolution (without any visual artifacts), without additional processing and decoding, to maintain the original native resolution without use of image processing to resize or scale the original signal feed.	9.1.3 VDS-000210	O
5	VDS Signal Extenders		
5-1	VDS Signal Extenders shall condition, amplify, and provide physical media conversion (i.e., copper to fiber optic or coaxial video to video over twisted pair) for audio and video signals to extend the maximum cabling distances from source devices to destination device.	9.1.4 VDS-000220	R
5-2	VDS Signal Extenders shall support, at a minimum, one of the following interconnects: coaxial, twisted pair, or fiber optical.	9.1.4 VDS-000230	R
6	VDS System Peripheral Connectors		
6-1	If the VDS system supports analog VGA and DVI computer connectors, then the following formats shall be supported: a. High resolution [up to 1920x1200 pixels Wide Ultra eXtended Graphics Array (WUXGA)] computer video resolutions operating at up to 60 Hz vertical refresh rate, or up to165 MHz total un-compressed pixel clock bandwidth. b. Analog VGA connectors with RGBHV, RGBS, or RGsB coaxial high definition video formats through use of RGBHV to VGA cabling adaptors. c. DVI connectors compatible with the Digital Display Working Group (DDWG) DVI 1.0 Specification, April 2, 1999.	9.1.5 VDS-000240	C

CR/FR ID	Requirement	UCR Ref (UCR 2013)	R/O/C
6-2	If the VDS system supports Multi-Rate SDI connectors, then the following Society of Motion Picture and Television Engineers (SMPTE) formats shall be supported: a. SMPTE 259M: Standard Definition SDI (SD-SDI). b. SMPTE 344M: Enhanced Definition SDI (ED-SDI). c. SMPTE 292M: High Definition SDI (HD-SDI). d. SMPTE 424M: 3-Gbps SDI (3G-SDI). e. SMPTE 291M: Ancillary Data Packet and Space Formatting.	9.1.5 VDS-000250	C
6-3	If the VDS system supports HDMI video connectors and provides support for digital video sources with and without High-Bandwidth Digital Content Protection (HDCP) copy protection, then the following HDMI features shall be supported: a. High-resolution (up to 1920x1200 pixels WUXGA) computer video resolutions operating at up to 60 Hz vertical refresh rate, or up to165 MHz total un-compressed pixel clock bandwidth. b. 24-bit color pixel depth and RGB and YCbCr color space. c. Embedded 2 CH Stereo Uncompressed Pulse Code Modulation (PCM) audio signaling over HDMI interface connections.	9.1.5 VDS-000260	C
6-4	The VDS system shall support EDID for VGA, DVI, and HDMI connectors. EDID support shall be provided by a VDS connector to describe the capabilities of the VDS system interface to a connected video source device. EDID interface signaling provided by the VDS to the source video device shall include the following: a. VDS Manufacturer ID. b. VDS Product Identification. c. Digital or analog capability of VDS Interface. d. Supported video resolutions and video timing modes of the VDS system. e. Preferred video resolution and video timing mode of the VDS system.	9.1.5 VDS-000270	O
7	VDS Peripheral Connector Conversion Devices		
7-1	VPCCs shall accept, couple, and convert from input to output for connector peripherals as described in Table 9.1-1, Summary of Connector Types.	9.1.6 VDS-000280	R
7-2	VPCCs shall accept high-resolution, up to 1920x1200 pixels WUXGA computer video resolutions, operating at up to 60 Hz vertical refresh rate, or up to165 MHz total un-compressed pixel clock bandwidth.	9.1.6 VDS-000290	R
7-3	VPCCs shall support upwards and downwards video resolution and frame rate signal processing.	9.1.6 VDS-000300	R
7-4	VPCCs shall use video scaling or signal processing to convert between different connector peripherals as described in Table 9.1-1, Summary of Connector Types.	9.1.6 VDS-000310	R
7-5	VPCCs shall allow for dynamic conversion or for user defined conversions to support display resolution formats with varying aspect ratios (4:3, 16:9, and 16:10).	9.1.6 VDS-000320	R
7-6	If VPCCs require local monitoring, then VPCCs shall support local HD-SDI/VGA/DVI/HDMI loop-through outputs (as needed for the video source format) for local monitoring.	9.1.6 VDS-000330	C
7-7	VPCCs shall auto-detect the type of peripheral present and provide video peripheral conversion and processing as needed to match the selected video peripheral of the attached video display or VDS subcomponent.	9.1.6 VDS-000340	R
7-8	VPCCs shall support Ethernet management interfaces for diagnostic information and control, including the following: a. Complete information about the device. b. Physical identification of hardware and a system error log.	9.1.6 VDS-000350	R
8	VDS Master Control Switch		
8-1	The VDS Master Control switch shall allow the end user to select and verify the processing of any signal displayed.	9.1.7 VDS-000360	R
8-2	The VDS Master Control switch shall be able to perform the following functions on the VDS Matrix Switch: a. Switch Single Input to Single Output. b. Switch Single Input to Multiple Outputs. c. Allow the user to "record" and "recall" presets of crosspoint routings over both the entire switch matrix and selected groupings of inputs and outputs.	9.1.7 VDS-000370	R

CR/FR ID	Requirement	UCR Ref (UCR 2013)	R/O/C
8-3	The VDS Master Control shall be able to perform the following functions on the VDS Matrix Switch: a. Switch Single Input to Single Output. b. Switch Single Input to Multiple Outputs. c. Enquire the status of any current configuration, by individual output, resulting in the current routed input information; by individual input, resulting in a listing of all current outputs; a master listing of all input names (if stored within the device); and a master listing of all current output assignments. d. Clear the switching or crosspoint (route "0") based on input, where any output with the selected input will be automatically cleared, or based on output, where only the selected output crosspoints are cleared. Clearing must result in NO INPUT selected rather than using a "blank" or "un-assigned" input.	9.1.7 VDS-000380	O
9	VDS Matrix Switch		
9-1	The VDS Matrix Switch shall accept original audio and video signals as defined in Section 9.1.2, VDS System Signal, and shall accept multiple connectors as defined in Section 9.1.4, VDS Signal Extenders, to interface to other VDS Matrix Switching Devices, VDS Distribution Devices, VDS Switching Devices, VDS Conversion Devices, and other VDS subcomponents.	9.1.8 VDS-000390	R
9-2	The VDS Matrix Switch shall support hot-swappable expansion modules.	9.1.8 VDS-000400	R
9-3	The VDS Matrix Switch shall support local and remote control management and control.	9.1.8 VDS-000410	R
9-4	The VDS Matrix Switch shall include a local primary control mode that supports a secondary external control mode as needed for redundancy. NOTE: Best practices indicate a need for backup distributed control systems (dual processors) in any large-scale VDS installation.	9.1.8 VDS-000420	R
9-5	If the VDS Matrix Switch is slated for specialized missions, the VDS Matrix Switch shall use custom rack mounts (e.g., Ship board operations). Otherwise, the VDS Matrix Switch shall support the industry standard 19-inch wide equipment racks.	9.1.8 VDS-000430	O
9-6	If the VDS Matrix Switch is slated for mission-critical C2 operations, then the VDS Matrix Switch shall include two or more hot-swappable power supplies with two independent power cords for redundancy.	9.1.8 VDS-000440	O
9-7	The VDS Matrix Switch shall provide at least one sub-control position with System Administrator permission access control.	9.1.8 VDS-000450	O
10	VDS IA Security		
10-1	All VDS components shall adhere to the appropriate STIGs.	9.1.9 VDS-000460	R
10-2	All VDS components shall meet all appropriate Ports, Protocols, and Services Management (PPSM) guidelines and vulnerability and risk assessments to achieve compliance for all information systems, applications, and services connected to the Global Information Grid (GIG).	9.1.9 VDS-000470	R
10-3	The VDS shall meet all appropriate Information Assurance (IA) and Vulnerability Assessment (IAVA) and National Institute of Standards and Technology (NIST)/National Information Assurance Partnership (NIAP) standards.	9.1.9 VDS-000480	R
11	VDS Availability		
11-1	The number of UI events shall be no more than 4.38 events per year. NOTE: UI events are critical service affecting events impairing critical components (i.e., a Matrix Switch as opposed to a Peripheral Device). A UI is any condition identified by a user making the system not operational. Table 9.1-2, Unscheduled Interruption Event Counts, depicts the number of events per system uptime.	9.1.10 VDS-000490	R
11-2	The duration of unscheduled interruption (DUI) events shall be no more than 2 hours per event. Table 9.1-3, Duration of Unscheduled Interruption Events, depicts the number of hours per event per year. NOTE: An entire system integrity check must be performed for outages lasting longer than 2 hours.	9.1.10 VDS-000500	R

CR/FR ID	Requirement	UCR Ref (UCR 2013)	R/O/C
11-3	The duration of scheduled outages shall be no longer than 0.5 hours per month and 6 hours per year. Table 9.1-4, Scheduled Maintenance Event Durations, depicts the allowable hourly/yearly durations for scheduled outages. NOTE 1: Scheduled maintenance is the duration of performing planned maintenance operations in which the system is not available to the user. NOTE 2: An entire system integrity check must be performed for outages lasting longer than 0.5 hours.	9.1.10 VDS-000510	R
11-4	All outages or service disruptions to the system shall be correctable within 2 hours using normal maintenance procedures.	9.1.10 VDS-000520	R
12	VDS Diagnostics		
12-1	The VDS Matrix Switch, VPCCs, and VDS signal Extenders shall provide system diagnostics to verify and validate proper system operation and status.	9.1.11 VDS-000530	R
12-2	The VDS Matrix Switch shall provide complete information about the device, including all software and firmware revisions; type of device; model number; IP address; serial number; Move, Add, Change (MAC) address; input signal resolution; original signal resolution; physical location of the unit (based on customer input at time of installation); internal temperatures of the unit; fan speed and status of each fan associated with the unit; and an error log pertaining to the unit.	9.1.11 VDS-000540	R
12-3	VPCCs and VDS signal Extenders shall be able to output an internally generated video signal in place of the input signal and an audio tone in place of the incoming audio.	9.1.11 VDS-000550	R
12-4	The VDS Matrix Switch, VPCCs, and VDS signal Extenders shall provide an interface capability to be monitored from a centralized monitoring and diagnostic VDS control location. At a minimum, feedback information shall include signal presence (e.g., connected/disconnected) for coaxial cable, signal format, signal strength (fiber cable only), input/output/matrix card presence and status, power supply status information, fan operation, internal operating temperatures, equipment error logging, and power received levels for all VDS cabling (fiber only) and audio/video signals supported by the equipment.	9.1.11 VDS-000560	R
12-5	The VDS Matrix Switch, VPCCs, and VDS signal Extenders shall support local control monitoring and remote control monitoring to a third-party interface, to include, at a minimum, feedback information that includes signal presence (e.g., connected/disconnected) for coaxial cable, signal format, signal strength (fiber cable only), input/output/matrix card presence and status, power supply status information, fan operation, internal operating temperatures, equipment error logging, and power received levels for all VDS cabling (fiber only) and audio/video signals supported by the equipment.	9.1.11 VDS-000570	R
13	Closed VDS System		
13-1	Closed VDS Systems shall comply with the General VDS System Requirements as outlined in Section 9.1, General VDS System.	9.2 VDS-000580	R
13-2	Closed VDS Systems shall support the IPv4 profile as defined in Section 7.2.1.5, Protocols, and the IPv6 profile as described in Section 5, IPv6.	9.2 VDS-000590	O
13-3	Closed VDS Systems shall interface with a VDS Matrix Switch controller.	9.2 VDS-000600	R
13-4	Closed VDS Systems shall support serial RS-232, RS-422, or RS-485 interfaces as required by the system.	9.2 VDS-000610	R
13-5	Closed VDS Systems shall support USB and Ethernet interfaces.	9.2 VDS-000620	O
13-6	Closed VDS Systems shall support a web-based configuration and control.	9.2 VDS-000630	O
14	VDS OVER IP (VDS-IP)		
14-1	VDS-IP Systems shall comply with the General VDS System Requirements as outlined in Section 9.1, General VDS System.	9.3 VDS-000640	R
14-2	VDS-IP Systems shall support the IPv4 profile as defined in Section 7.2.1.5, Protocols, and the IPv6 profile as described in Section 5, IPv6.	9.3 VDS-000650	R

CR/FR ID	Requirement	UCR Ref (UCR 2013)	R/O/C
14-3	If the VDS-IP system uses standards-based video or picture conversion, compression, and encoding methods, then the VDS system shall be categorized as an Open Distribution VDS System. Otherwise, the system is a Proprietary Distribution VDS System. a. Open Distribution. This type of VDS-IP system shall use standards-based video or picture conversion, compression, and encoding methods coupled with a STIG and PPSM approved IP transport mechanisms. Audio and video shall be viewable in hardware or software interfaces. b. Proprietary Distribution. This type of VDS-IP system shall use STIG and PPSM-approved IP transport mechanisms, but is not required to use standards based video or picture conversion, compression and encoding methods.	9.3 VDS-000660	O
14-4	VDS-IP Codecs shall use MPCA and/or PCA formats based on mission objectives. NOTE: MPCA standards are defined in Section 3.4, UC Audio and Video Conference System.	9.3 VDS-000670	O
14-5	Open Distribution VDS-IP systems shall comply with all Unified Capabilities (UC) Audio and Video Conference System Requirements as defined in Section 3.4, UC Audio and Video Conference System.	9.3 VDS-000680	R
14-6	Proprietary Distribution VDS-IP systems shall comply with all IP Transport and Proprietary Codec requirements as defined in the UC Audio and Video Conference System Requirements as defined in Section 2.6, SC and SS Failover.	9.3 VDS-000690	R
14-7	VDS-IP Systems shall comply with the following PCA formats: a. JPEG, JPEG2000, VC-1, Dirac, VP8 or other compression codecs based on Discrete Cosine Transform (DCT) or Discrete Wavelet Transform (DWT). b. PNG.	9.3 VDS-000700	R
14-8	VDS-IP subcomponents shall support serial RS-232, USB, or Ethernet.	9.3 VDS-000710	R
14-9	VDS-IP systems shall support a web-based configuration and control.	9.3 VDS-000720	R
14-10	VDS-IP systems shall interface with a VDS Matrix Switch controller.	9.3 VDS-000730	R
15	VDS-IP Codec		
15-1	VDS-IP shall fall into one of two categories: VDS-IP Hardware Codec or VDS-IP Software Codec.	9.3.1 VDS-000740	O
15-2	VDS-IP Hardware Codecs shall accept computer graphic input resolutions to include VGA, SVGA, XGA, SXGA, SXGA+, UXGA, WUXGA, 1920x1080, and custom computer graphic resolutions and input modes.	9.3.1 VDS-000750	R
15-3	VDS-IP Hardware Codecs shall provide reliable decoding during live configuration changes or selection of new active audio and video data streams (e.g., decoding device does not require restart, resync, or reboot to acquire newly selected data stream).	9.3.1 VDS-000760	R
16	VDS Recording		
16-1	VDS Recording Devices shall fall into one of two categories: a. Video Tape Recorder (VTR). A device that captures and archives video and/or audio material on a magnetic tape (e.g., video tape, compact cassette). b. Digital Video Recorder (DVR). A device or application software that captures and archives video and/or audio in a digital format to a disk drive, USB flash drive, Standard Definition (SD) memory card, or other local or networked mass storage device.	9.4 VDS-000770	R
16-2	VTR Recording Devices shall adhere to the requirements specified in Section 9.4.1, VDS Video Tape Recording (VTR).	9.4 VDS-000780	R
16-3	DVR Recording Devices shall adhere to the requirements specified in Section 9.4.2, VDS Digital Video Recording (DVR).	9.4 VDS-000790	R
17	VDS Video Tape Recording		

CR/FR ID	Requirement	UCR Ref (UCR 2013)	R/O/C
17-1	VTR devices shall accept standard and high-definition video using the following SMPTE formats: a. SMPTE 259M: SD-SDI. b. SMPTE 344M: ED-SDI. c. SMPTE 292M: HD-SDI. d. SMPTE 424M: 3G-SDI. e. SMPTE 291M: Ancillary Data Packet and Space Formatting.	9.4.1 VDS-000800	R
17-2	VTR devices shall accept standard and high-definition video using the following SMPTE formats: a. SMPTE 372M: Dual-Link (DL) HD-SDI. b. Digital Picture Exchange. NOTE: The SMPTE defines the standard for many video tape recording (VTR) protocols.	9.4.1 VDS-000810	O
18	VDS Digital Video Recording (DVR)		
18-1	DVR devices shall be capable of recording and replaying video and audio using MPCA and Audio Compression Algorithms (ACAs) as defined in Section 3.4, UC Audio and Video Conference System, and shall be able to capture Picture Compression Algorithms (JPEG and PNG).	9.4.2 VDS-000820	R
18-2	DVR devices shall be capable of recording and replaying video using MPEG-4 Part 2, MPEG-2 .mpg, MPEG-2 .TS, VOB, and International Organization for Standardization (ISO) video.	9.4.2 VDS-000830	O
18-3	DVR devices shall be capable of recording and replaying audio using MP3, AC3, and Ogg.	9.4.2 VDS-000840	O
18-4	DVR devices shall integrate with the monitor and/or TV set.	9.4.2 VDS-000850	O
18-5	DVR devices shall be VESA compatible.	9.4.2 VDS-000860	O
18-6	DVR devices shall be able to interface with PC-based compatible devices running Microsoft Windows, Linux, or Mac OS.	9.4.2 VDS-000870	O

CR/FR ID	Requirement	UCR Ref (UCR 2013)	R/O/C

LEGEND:

3G-SDI	3-gigabits per second Serial Digital Interface	Ogg	Operation Good Guys
ACA	Audio Compression Algorithm	OS	Operating System
C	Conditional	PC	Personal Computer
C2	Command and Control	PCA	Protocol Communication Adapters
CH	Channel	PCM	Pulse Code Modulation
CR	Capability Requirement	PNG	Portable Network Graphics
DCT	Discrete Cosine Transform	PPSM	Ports, Protocols, and Service Management
DDWG	Digital Display Working Group	R	Required
DL	Dual-Link	Ref	Reference
DoD	Department of Defense	RGB	Red Green Blue
DoDAF	DoD Architecture Framework	RGBHV	Red Green Blue Horizontal/Vertical Sync
DUI	Duration of Unscheduled Interruption	RGBS	Red Green Blue Composite Sync
DVD	Digital Video Disc	SC	Session Controller
DVI	Digital Visual Interface	SD	Standard Definition
DVR	Digital Video recording	SDI	Serial Digital Interface
DWT	Discrete Wavelet Transform	SD-SDI	Standard Definition Serial Digital Interface
EDID	Extended Display Identification Data	SIPR	Secure Internet Protocol Router
ED-SDI	Enhanced Definition Serial Digital Interface	SMPTE	Society of Motion Picture and TV
FR	Functional Requirement	Engineers	
HDCP	High-Bandwidth Digital Content Protection	SS	Softswitch
HDMI	High Definition Multimedia Interface	STIGs	Security Technical Implementation Guides
HD-SDI	High Definition Serial Digital Interface	SVGA	Super Video Graphics Array
Hz	Hertz	SXGA	Super eXtended Graphics Array
IA	Information Assurance	SXGA+	Super Video Graphics Array Plus
ID	Identification	T	Test
IP	Internet Protocol	TP	Test Procedure
IPv4	IP version 4	TS	Top Secret
IPv6	IP version 6	TV	Television
ISO	International Organization for Standardization	UC	Unified Capabilities
JPEG	Joint Photographic Experts Group	UCR	Unified Capabilities Requirements
LoC	Letter of Compliance	UI	Unit Interface
MAC	Media Access Control	USB	Universal Serial Bus
MHz	Megahertz	UXGA	Ultra eXtended Graphic Array
MP3	Moving Picture Experts Group Layer -3 Audio	VDS	Video Distribution System
MPCA	Multi-Protocol Communications Adapter	VESA	Video Electronics Standards Association
MPEG	Moving Pictures Expert Group	VGA	Video Graphics Array
N/A	Not Applicable	VOB	Video Object file
NIAP	National Information Assurance Partnership	VPCC	VDS Peripheral Connector Conversion
NIPR	Non-Secure Internet Protocol Router	VTC	Video Teleconferencing
NIST	National Institute of Standards and Technology	VTR	Video Tape Recording
O	Optional	WUXGA	Wide Ultra eXtended Graphics Array
OBM	Out-of-Band Management	XGA	eXtended Graphics Array
		YCbCr	Green (Y), Blue (Cb), Red (Cr)

Joint Interoperability Certification Revision History

Revision	Date	Approved By	Comments
N/A	2 February 2015	Bradley Clark	This is the original certification memo.
1	12 February 2015	Anita Brown	The following changes are made : • Memo, Page 3, Table 4. Part number was changed from "MX R-00048-FM" to MXR-00048-FM. • Memo, Page 3, Table 4. Part number was changed from "VTM-H00004-LCTX to "VTM-U00004-LCTX." • Memo, Page 3, Table 4. Part number was changed from "VTM-H0000-LCRX" to "VTM-U00004-LCRX." • Enclosure 2, Page 2-4, paragraph beginning with "VTM-00004-LCRX. Part number was changed from "VTM-00004-LCRX" to "VTM-U00004-LCRX." • Enclosure 3, Page 3-2, Table 3-3, Component column. Part number was changed from "MX R-00048-FM" to "MXR-00048-FM." • Enclosure 3, Page 3-2, Table 3-3, Component column. Part number was changed from "VTM-H00004-LCTX" to "VTM-U00004-LCTX." • Enclosure 3, Page 3-2, Table 3-3, Component column. Part number was changed from "VTM-H0000-LCRX" to "VTM-U00004-LCRX."
1	20 February 2015	Anita Brown	Added Enclosure 4, Joint Interoperability Certification Revision History. Removed pages labeled, "(This page intentionally left blank.)" Reformatted headers, footers, and page numbers.
LEGEND: N/A Not Applicable SUT System Under Test			